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## THE LAND MOLLUSKS OF THE LOO CHOO ISLANDS: CLAUSILIIDÆ.

BY HENRY A. PILSBRY.

Seven or eight years ago, at the time of my first studies upon Japanese mollusks, only two species of *Clausilia* were known from the Loo Choo Islands: *C. valida* Pfeiffer,<sup>1</sup> described from specimens collected by Largilliert, and *C. præclara* Gould,<sup>2</sup> collected by William Stimpson, naturalist of the U. S. North Pacific Exploring Expedition, under Commanders Ringgold and Rodgers.

Mr. Frederick Stearns brought a third species, taken on Okinawa, which I described in 1894 as *C. Stearnsii*,<sup>3</sup> and a fourth was sent in 1900 by Mr. Hirase, *C. hyperoptyx*,<sup>4</sup> from the same island.

Two other species, *C. Bernardii* Pfr. and *C. ptychochila* Bttg., supposed to be from Siam and China respectively, seem from their characters to be so near Loo Chooan species that I think their formerly assigned habitats were probably erroneous, and that both really came from the Loo Choo Islands. Acting upon this hypothesis, I provisionally include them in the following account.

Through the researches conducted by my esteemed correspondent, Mr. Y. Hirase, the number of species known from these beautiful and interesting islands has now been increased to eleven,<sup>5</sup> not counting the two species of doubtful provenance alluded to above.

Up to this time we have received species from only three islands: Yayeyama in the southwestern group, Okinawa or Great Luchu in

<sup>1</sup> *Zeitschr. f. Malak.*, 1849, p. 106; *Mon. Hel. Viv.*, III, p. 591. Küster, *Conchyl. Cab.*, *Clausilia*, Pl. 23, figs. 1-3, figures of Pfeiffer's type.

<sup>2</sup> *Proc. Bost. Soc. Nat. Hist.*, VI, p. 425, February, 1859; *Otia Conch.*, p. 103. The name *præclara* being preoccupied in *Clausilia*, Pfeiffer changed it to *C. excellens*, *Jour. de Conchyl.*, p. 268 (1861), basing the new name on Gould's description.

<sup>3</sup> *Nautilus*, VIII, p. 47 (August, 1894); *Catal. Mar. Moll. Jap.*, Appendix, p. 163, Pl. 1, fig. 12.

<sup>4</sup> These *Proceedings*, 1900, p. 446, Pl. XIV, figs. 12-14.

<sup>5</sup> This includes the species of Oshima, as this island belongs both geographically and faunally to the Loo Choo group. Being politically a part of Kagoshima Ken or prefecture, it is not usually considered by the Japanese to be one of the Loo Choo group, which in ordinary parlance includes merely the Central and Further groups of islands, belonging to Okinawa Ken.

the central group, and Oshima in the northeastern group. There can be no doubt that when other islands are explored many more species will be brought to light, and our zoögeographic knowledge correspondingly expanded.

The known species fall into five subgenera or sections: *Stereophædusa*, *Luchuphædusa*, *Hemiphædusa*, *Tyrannophædusa* (?) and *Zptyx*. Of these, the section *Luchuphædusa*, comprising about half the species now known, has been found nowhere but on these islands. *Zptyx* extends into the southernmost provinces of Kiusiu, in the neighborhood of Kagoshima Bay; and probably borne by the "Kuro Shiwo" has reached Hachijo, an islet a hundred miles off Izu province; but a Loo Chooan origin of the group seems probable. *Stereophædusa* and *Hemiphædusa* range further, being common throughout Japan, and the latter group is widespread on the Chinese mainland; but the species of the Loo Choo Islands belong to a special group of *Hemiphædusa* which has not been found elsewhere. The single species referred doubtfully to *Tyrannophædusa* has no close relatives, but seems nearer to Japanese than to any Chinese species known to me. The sections *Euphædusa* and *Megalophædusa*, so characteristic of Japan, are wanting in the Loo Choos, so far as present information goes; and *Reinia* has not been found. So much for the distribution of the groups. Descending to *species*, we find not one common to the Loo Choo Islands and any other land.

The general affinities of the *Clausilia* fauna, we may conclude, are closest with Japan, though the endemic element is so strong that no relationship at all intimate can be claimed. No characteristic Formosan forms of *Clausilia* have been found in the Loo Choo group.

#### Section STEREOPHÆDUSA Bttg.

##### *Clausilia valida* Pfr.

Originally described from the "Liew Kiew" Islands, this species is known from Okinawa Island only. It has been collected there by the Japanese collectors sent by Dr. Adolph Fritze in 1891, by Mr. Frederick Stearns about the same time, and has also been taken by Mr. Hirase's collector. The typical form is uniform brownish yellow.

The chestnut-banded form with the coarse sculpture of the type has been named var. *fasciata* by Mr. E. R. Sykes.<sup>6</sup>

Another banded variety may be called var. *perfasciata*. It is similar to *C. valida fasciata* Sykes, but larger, the broad purple-brown band more strongly contrasted with the whitish or pale buff bands above and below it; aperture longer, more piriform. The sculpture is perceptibly finer than in *valida*. The types of this form are from the province Kunchan, Okinawa Island (No. 633 of Mr. Hirase's collection).

A third form of the species, var. *striatella*, nov., has the coloring of var. *fasciata*, but darker on the last two whorls, with the same rather wide aperture, dusky purplish within; but the surface is far more finely striated, there being fully twice as many striæ as there are in *valida*. The size is about the same.

Length 28, diam. 6 mm.,  $7\frac{1}{3}$  whorls remaining.

Length  $25\frac{1}{2}$ , diam.  $6\frac{1}{3}$  mm.,  $6\frac{1}{2}$  whorls remaining.

The types are 79,116 Coll. A. N. S. P., from 462 of Mr. Hirase's collection, labeled "Loo Choo."

*Clausilia Stearnsii* Pilsbry.

The types were taken on Okinawa by the collector sent by Mr. Frederick Stearns in 1891-2. They measure, length 26 to 31, diam. 5 mm. Specimens sent this year from Yayeyama by Mr. Hirase (No. 622) measure 26-28 by 5 mm. Others sent from "Loo Choo" are more slender, length 25- $25\frac{1}{2}$ , diam.  $4\frac{1}{3}$  mm., with 12 whorls and a less distinct lunella than the types.

*C. Stearnsii* is very distinct by its receding inferior lamella and the development of a lunella, both being characters unlike most other species of *Stereophædusa*.

Section LUCHUPHÆDUSA nov.

Clausilium wide, *truncate* or *notched distally*, and with a thickened lobe or finger-like process on the columellar side of the apex, standing at nearly a right angle with the body of the plate.

Shell fusiform, the right margin of the peristome usually crenate, outer margin excavated above to form a sinulus; superior lamella marginal, projecting, continuous with the long spiral lamella;

<sup>6</sup> *The Conchologist*, II, p. 118. Figure 52 of Sowerby's monograph in the *Conchologia Iconica*, XX, evidently is intended to represent one of the specimens mentioned by Mr. Sykes.

*inferior lamella strongly spiral within*, calloused below; subcolumellar lamella *dilated adjacent to the very long and strong lower palatal plica*, which is united with the lunella, when that is present; principal plica long; upper palatal plica developed, sometimes coalescent with the lunella.

The shell in this section is similar to that of the group of *C. ptychochila* in general characters, but differs in the dilation of the subcolumellar lamella and in the much higher, simple spiral plate of the inferior lamella within the last whorl. Like the group mentioned, its peculiarities are an exaggeration of the *platydera* group of *Hemiphaedusa*, which may be looked upon as a sort of unspecialized branch of the common stock. The clausilium, however, is so peculiar and unlike any Phædusoid group hitherto known, that the erection of a new section is required. The lamellæ and plicæ are all very strongly developed within, and the former are unusually long, passing the ventral position.

*Luchuphaedusa* has much in common with the section *Emarginaria* Bttg. of the German upper Miocene, in which a similar emarginate or notched clausilium and the same interlamellar plication is developed; but the Miocene forms retain a primitive structure of the palatal region, where several plicæ are developed, while *Luchuphaedusa* is very highly specialized there. The resemblance is partially due to convergent evolution.

*Key to species of Luchuphaedusa, by external characters.*

- 1.—Right margin of the peristome crenulate:
  - a.—Aperture narrow, the sinulus strongly developed; principal plica reaching to the lip; last whorl strongly compressed (Oshima).
    - b.—Subcolumellar lamella wholly immersed (though the lip is crenate at its position), . . . *C. oshimæ*.
    - b'.—Subcolumellar lamella emerging to the lip-edge, *C. pseudoshimæ*.
  - a'.—Aperture moderately wide, of normal proportions, piriform-ovate; principal plica immersed, as usual.
    - b.—Rather large, the broad right lip deeply plicate; length about 23 mm. (Okinawa), *C. callistochila*.
    - b'.—Small, length about 12 mm.: the right lip narrow and not very strongly crenate (Oshima), *C. mima*.
- 2.—Right margin of the peristome smooth; aperture semicircular; inferior and subcolumellar lamellæ emerging to the lip-edge; length 30–34 mm. (Oshima), . . . *C. nesiothauma*.

All of the species of this section are new, and from the two islands Okinawa and Oshima.

*Clausilia callistochila* n. sp. Pl. XXII, figs. 1, 2, 3.

Shell thick and strong, pale brown, or green from adhering algæ, rimate, turreted, the upper third of the length attenuated, with slightly concave outlines, the lower two-thirds rather swollen, the penultimate whorl widest, the last half of the last whorl contracted, compressed laterally. The apex is obtuse. Whorls  $11\frac{1}{2}$ , the early ones worn smooth, the rest closely rib-striate, the riblets on the last whorl coarser and more widely spaced, somewhat undulating and irregular. Aperture vertical, rhombic-piriform, with distinct sinulus, the peristome expanded and reflexed, thick, white, the left margin wide and thick as far up as the sinulus, where it is abruptly excavated; *right margin, from the superior lamella to the base, deeply cut into rounded entering wrinkles*, which deeply crenulate the lip-edge. Superior lamella subvertical, rather thick, emerging to the margin, continuous with the high, long and strongly developed spiral lamella. Inferior lamella subhorizontal, strongly approaching the superior lamella within, heavy, not reaching the lip-margin, very strongly spiral inside. Subcolumellar lamella emerging to the lip-edge, where it forms one of the series of lip-folds. Principal plica strong and nearly a whorl long, reaching nearly to the lip; extending inward far beyond the lunella. Upper palatal plica long, converging inwardly toward the principal plica; lunella short and *very obliquely running inward*, arising below from a *very strong and high, angularly bent, long, lower palatal plica*.

Clausilium (Pl. XXII, fig. 4) broad, irregularly curved, abruptly truncate below, slightly thickened along the palatal margin, the apical end of the columellar margin much thickened, bent nearly at a right angle with the rest of the surface, producing a blunt tooth or lobe.

Length 24, diam.  $5\frac{3}{4}$ , longest axis of aperture  $5\frac{3}{4}$  mm.

Length  $22\frac{3}{4}$ , diam.  $5\frac{3}{4}$ , longest axis of aperture 6 mm.

Province Kunchan, Okinawa (Mr. Y. Hirase, No. 634).

An extraordinary species, not only by the interpalatal lamellæ which deeply crenulate the lip, but also by the long and high lower palatal fold and very oblique lunella; the two united in such fashion as to make the figure of an almost prostrate letter λ, reminding one of the lunella of some of the *C. platydera* group of

*Hemiphaedusa*, but unlike that group, an upper palatal plica is developed. The clausilium is very peculiar.

*Clausilia nesiothauma* n. sp. Pl. XXII, figs. 19, 20, 21.

Shell large, fusiform, rather obese below, moderately tapering above, fleshy-whitish, the surface lustreless and (where not overgrown with algæ or worn smooth) sculptured with moderately coarse, somewhat waved rib-striæ, branching or with intercalated striæ on the upper half of the last whorl. Apex small, the first whorl rapidly enlarging, sometimes self-amputated and plugged. Whorls 10, the last tapering below, having a broadly rounded basal crest running to the lower angle of the aperture. Aperture vertical, *semicircular* in general contour, obtusely angular at the sinulus and at the foot of the columella; the inner margin being straightened, the outer rounded. Peristome white, the outer and basal margins flaring, broadly reflexed, the inner margin sloping, emarginate at the termination of the superior lamella, arcuate along the interlamellar space, then straightened. Superior lamella strong, slightly oblique, marginal, continuous with the spiral lamella. Inferior lamella very strong, calloused and thick, forming a squarish columellar fold, abruptly lower or sometimes bifid where it extends upon the peristome. Subcolumellar lamella emerging, very strong and prominent, extending to the lip-edge. Principal plica about one-third of a whorl long, lateral in position. Lunella arcuate, its upper end curving well inward (being completely united with, and curving into, a short upper palatal plica); below, the lunella becomes strong and high, and joins the middle of an extremely strong, long, arched lower palatal fold, the summit of which curves downward and almost meets a broad, erect plate which at this point rises from the subcolumellar lamella. The lower end of the lower palatal plica is visible from the aperture, in a front or slightly oblique view. The inferior lamella is continued inward as a strongly spiral erect plate, rather distant from the spiral lamella on the dorsal side, but approaching it and becoming rather abruptly lower ventrally, both penetrating to beyond the middle of the ventral side. The subcolumellar lamella inward from the expansion toward the lower palatal plica, is slightly sigmoid, and not parallel inside with the inferior lamella.

Clausilium (figs. 15, 16) rather broad in the middle, slightly tapering toward each end, the lower end abruptly truncate, emar-

ginate or notched, a somewhat thickened, finger-like and more curved process extending downward on the columellar side; proximal end passing gradually into the rather broad filament.

Length 34, diam. 7.8, longest axis of aperture 9.4 mm.

Length 30.5, diam. 7.5, longest axis of aperture 9 mm.

Oshima (Mr. Y. Hirase, No. 652).

Readily known by its large size and the peculiar shape of the aperture.

*Clausilia oshimæ* n. sp. Pl. XXII, figs. 5, 6.

Shell fusiform, the upper third slender and somewhat attenuated, the lower half rather swollen; penultimate whorl widest. Very solid and strong. Pale brownish, more or less eroded. Closely and rather strongly striate. Apex small, the first whorl rapidly increasing, next three or four whorls very slowly widening; whorls about  $11\frac{1}{2}$ , the last whorl tapering, *laterally compressed*, flattened, having a shallow pit behind the middle of the outer lip, rounded at the base. Aperture ear-shaped, oblique, produced in a *deep retracted sinus* above. Peristome reflexed, thickened, a slight ridge running behind the outer lip parallel with it; outer lip obtusely toothed at the termination of the principal plica, thin above, rather broad below the tooth. Inner lip projecting in the middle, *cut into six or eight rounded, unequal interlamellar folds*, and similarly or more weakly crenate to or below the subcolumellar lamella. Superior lamella vertical, emerging beyond the general level of the peristome, continuous with the spiral lamella. Inferior lamella very prominently projecting into the aperture, subhorizontal and somewhat thickened below. *Subcolumellar lamella wholly immersed*, but replaced on the lip by rugæ occupying its place. *Principal plica very long, reaching to the lip* and running inward over a whorl; very strong. Upper palatal plica short, weak and lateral; lower palatal plica very strong and long, its lower end visible within the aperture, in an oblique view. Lunella apparently wanting. Within, the inferior lamella is a very high, strongly but somewhat irregularly spiral plate; the spiral lamella is also very high, almost touching the principal plica; and both lamellæ penetrate far past the ventral side. The subcolumellar lamella is short as usual, but strong near its deeply immersed lower end.

Length 22.5, diam. 4.5, longest axis of aperture 5.6 mm.

Length 21, diam. 4.5, longest axis of aperture 5 mm.

The clausilium (Pl. XXII, figs. 12, 13, 14) is strongly curved below, and becomes very thick toward the apex. The distal end has two apices separated by a notch, the outer one conic and rather broad, the inner blunt and bent nearly at a right angle with the body of the plate.

Nase, Oshima (Mr. Y. Hirase, No. 653a).

This exceedingly peculiar species has the crenulate right lip of most of its group, but it differs from all known species except the next in the great development of the posterior bay or "sinulus" of the aperture. It is difficult to gain a correct conception of the closing apparatus, so contracted is the cavity of the last whorl by the enormously developed lamellæ and plicæ. The deeply immersed subcolumnellar lamella is a prominent feature, differentiating *C. oshimæ* from *C. pseudoshimæ*; but as I have remarked above, this is masked by the sulcation of the lip, by which rounded lamellæ are produced in the subcolumnellar position.

*Clausilia pseudoshimæ* n. sp. Pl. XXII, figs. 7, 8, 9, 10.

Shell very similar externally to *C. oshimæ*; a little smaller; aperture and lip the same, except that *the subcolumnellar lamella emerges to the lip-edge*. Internal structure the same, except that the spiral trend of the inferior lamella, as seen from the back in an opened shell, is made irregular by two prominent angles; there is a rather long, latero-dorsal, upper palatal plica opposite the great lateral dilation of the inferior lamella. The very long lower palatal plica gives off *a very short and extremely oblique lunella in a ventral position*, where the clausilium lodges. The clausilium (Pl. XXII, fig. 11) has two subequal blunt apical points, separated by a rather wide notch.

Length 19.3, diam. 4, longest axis of aperture 5 mm.

Length 17, diam. 4, longest axis of aperture 4.7 mm.

Furuniya, Oshima (Mr. Y. Hirase, No. 653b).

Strikingly like *C. oshimæ* in general aspect, yet readily distinguishable by a number of important internal characters. On cutting the shell it is found to be decidedly less strong than in the other species. The clausilium lodges in a ventral position. The form of the basal lip is poorly represented in fig. 8. The other figures show it correctly.

*Clausilia mima* n. sp. Pl. XXIII, figs. 37, 38, 39.

Shell small, fusiform, rather obese, but rapidly tapering and conspicuously attenuated above; thin and not very strong, pale brown, densely and finely rib-striate. Whorls  $8\frac{1}{2}$  to 9, convex, the apex rather large, next three or four whorls widening but little; last half of the last whorl much contracted, flattened. Aperture somewhat oblique, small, piriform, with moderately well-defined sinulus. Peristome reflexed, slightly thickened, the outer margin excavated above, the upper and right margins more or less crenulate, the crenulation varying from strong to subobsolete in different specimens. Superior lamella vertical, emerging a little beyond the general level of the peristome, slightly wider or bifid at the margin; continuous with the spiral lamella. Inferior lamella forming a rather strong subhorizontal fold within, not emerging to the peristome. Subcolumellar lamella emerging, marginal. Principal plica about a half whorl long, extending from the dorsal to the middle of the ventral side. Upper palatal plica lateral, arcuate, converging inward toward the principal plica, the outer end contiguous to the lunella, the upper end of which curves toward and is almost united with it. Lunella lateral in position, oblique, weak above, strong below, where it unites with the middle of a long, very strong and angularly bent lower palatal plica. The subcolumellar lamella is abruptly and strongly dilated in the region of the lower palatal plica, and is bent over toward it; beyond this dilation it curves abruptly and ascends the internal column in the usual manner, expands again and turns toward the right, parallel to the other lamellæ upon the roof of the penultimate whorl. The inferior lamella within the last whorl is stout, high, very strongly spiral, and with the spiral lamella continues inward past the ventral side, upon which the three lamellæ run parallel.

Length  $13\frac{1}{2}$ , diam.  $3\frac{1}{2}$  mm.

Length  $11\frac{1}{2}$ , diam. 3 mm.

Clausilium (Pl. XXII, figs. 17, 18) broad, strongly curved, broadly rounded along the outer margin, truncate at the apex, and produced on the columellar side into a long finger-like process.

Oshima (Mr. Y. Hirase, No. 654).

Much smaller than other species of the section, and strongly attenuated above, like *C. brevior* v. Mart. The process of the

clausilium is also longer, and the whole plate is strongly twisted spirally.

Section HEMIPHÆDUSA Bttg.

*Group of C. ptychochila.*

In this group the right lip or interlamellar space is more or less crenate; the superior and subcolumellar lamellæ are marginal, the inferior lamella somewhat receding, thickened below, strongly sigmoid within, and in the middle of the dorsal aspect it is low, wide and bifid, as if composed of two cords twisted round one another. The lower palatal plica is very strong, elevated in the middle where the lunella joins it, the latter being very strong below, weak above. The clausilium (Pl. XXIII, figs. 26-29) is wider in the middle than in *Hemiphædusa*, tapering above and below, strongly curved toward the thickened, obtuse apex, and with the lateral margins bent nearly at right angles with the rest of the plate, forming a sort of spout-like distal extremity (Pl. XXIII, figs. 27, 28).

This group is probably entitled to separate sectional rank. It is related to the Japanese group of *C. platydera*, but differs in the form of the inferior lamella within the last whorl, and in the clausilium.

*Key to species.*

1.—Inferior lamella thickened but simple below:

*a.*—Surface strongly ribbed; subcolumellar lamella somewhat dilated in the part adjacent to the lower palatal plica,  
*C. Bernardii.*

*a'.*—Surface more finely costulate:

*b.*—Lunella becoming very weak and curving inward above, strong and high below; subcolumellar lamella not dilated near the lower palatal plica; upper palatal plica weak, . . . *C. crenilabium.*

*b'.*—Lunella straight; shell more obese, *C. ptychochila.*

2.—Inferior lamella bifid below, . . . . . *C. excellens.*

*Clausilia Bernardii* Pfr. Pl. XXIII, figs. 30, 31, 32.

*C. Bernardii* Pfr., Journ. de Conchyl., IX, 1861, p. 267, Pl. 15, figs. 1, 2; Monogr. Hel. Viv., VI, p. 426.

This species was described as from Siam. It has not been found by any later collectors in that region, and there are grave reasons for considering the locality erroneous.

The original specimens from Bernardi's collection were dis-

tributed to Pfeiffer, the Academy of Natural Sciences of Philadelphia, and perhaps to other collections; and I suppose the figured type is preserved in the collection of the *Journal de Conchyliologie* in Paris.

Upon examining the species, I find that it is very closely related to my *C. crenilabium* of Kunchan, Okinawa; in fact, so intimately, that I have no doubt that *C. Bernardii* really came from Okinawa or some other island of the Loo Choo chain. No species of the same group has been found in China, Tonquin or elsewhere on the mainland, and it is apparently a local group, specialized on these islands.

The source whence Bernardi procured his specimens is not stated, but it is significant that in the same volume of the *Journal* several species from Japan and the Loo Choo Islands, collected by a French naval officer, M. Thomas, are described. Probably *C. Bernardii* was one of the species taken by him in Loo Choo.

*C. Bernardii* differs from *C. crenilabium* in having the surface-sculpture very much coarser. The lunella is very strong below, where it joins the middle of an elevated conic lower palatal fold, the apex of which overhangs or curves downward in the middle. Above, the lunella rapidly weakens, and curves backward into the low upper palatal fold, which also has a low continuation on the other side—apertureward—of the lunella. The projecting squarish inferior lamella is much thickened below, and within the last whorl it has the peculiar shape seen in *C. crenilabium*, the spiral portion being superposed at the side of, rather than continuous with, the externally visible part of the inferior lamella. It is very strong, somewhat expanded in the region of the lunella. The spiral and inferior lamellæ are of equal length, and continue inward past the ventral position, to a point in line with the superior lamella. In *C. crenilabium* both lamellæ extend further inward, and the spiral lamella is decidedly longer than the other. The crenulation of the interlamellar space is coarser in *Bernardii* than in *crenilabium*. There are 11 whorls, the upper ones more attenuated than in *crenilabium*, and the color is corneous-white, not brownish.

The clausilium of *C. Bernardii* is shaped almost exactly as in *C. crenilabium*, broad in the middle, tapering and strongly curved toward the apex, which is obtuse, slightly thickened and spout-

like, from having the lateral edges of the tapering portion abruptly bent toward the convex side of the clausilium. The palatal margin is especially widely reflexed and flattened.

**Clausilia ptychochila** Boettger. Pl. XXIII, figs. 40, 41, 42.

Clausilienstudien, p. 66 (1877); Jahrb. d. D. Malak. Ges., V, p. 57, Pl. 3, fig. 8 (1878).

The habitat of this species is unknown. It was described from a single specimen, supposed to be from China, but without record of locality. From its characters I think it will be found on Okinawa or some neighboring island.

The type measures, length  $24\frac{1}{2}$ , diam.  $6\frac{1}{2}$ , length of aperture  $6\frac{1}{2}$ , width  $4\frac{1}{2}$  mm. It is swollen-fusiform, densely costulate and whitish-corneous, the spire concavely attenuated. Whorls 11. The aperture is rhombic-piriform, peristome much thickened, sinuate and appressed above. There is a groove separating the superior lamella from the numerous folds which corrugate the interlamellar space. The inferior lamella is callous below. "The small upper and the longer lower palatal plicæ are united with the short, straight lunella, which at its base gives off a distinct branch backward." The clausilium has not been described.

Boettger's description and figures show this to be a species closely related to *C. crenilabium* and *C. Bernardii*. It differs from the former in being more inflated, with the lunella apparently straight, not curving inward above, and nothing is said to indicate that the lower palatal plica has the great height at its junction with the lunella and the strong development seen in *C. crenilabium*. It is apparently more finely sculptured than *C. Bernardii*. Further collections are needed to determine whether these three species are constantly distinct or united by intermediate examples. Numbers of specimens of *C. Bernardii* and *C. crenilabium* show no tendency toward intergradation, and with present knowledge I would not feel justified in uniting the three species.

Dr. von Möllendorff has placed *ptychochila* in the synonymy of *excellens* (Jahrb. D. Mal. Ges., X, p. 269). This union is inadmissible.

**Clausilia crenilabium** n. sp. Pl. XXIII, figs. 23, 24, 25, 33.

Shell thick and strong, brownish buff, rimate, turreted, attenuated above, moderately swollen below, the last whorl contracted, penultimate whorl widest. Whorls about  $11\frac{1}{2}$ , slightly convex,

sculptured with close, regular and rather fine rib-striæ, coarser on the last whorl. Aperture vertical, rhombic-piriform, the peristome white, reflexed, somewhat thickened, the outer lip excavated above to form an indistinct sinulus; *the upper margin to the right of the superior lamella is cut into 3 to 5 entering folds, deeply crenulating the lip-edge; the rest of the right margin is weakly and irregularly subcrenulate.* Superior lamella strong, slightly oblique, attaining the margin, continuous with the long and high spiral lamella. Inferior lamella strong, approaching the superior, not reaching upon the lip, very heavy and callous below, strongly spiral and with a superposed callus within. Subcolumellar lamella emerging. Principal plica rather long and strong, visible within the aperture, extending inward slightly beyond the latero-ventral lunella. Upper palatal plica small and low, united with the lunella. Lower palatal plica short and high, angularly elevated and overhanging downward in the middle, where the strong lunella joins it.

Clausilium (Pl. XXIII, figs. 26-29) well curved, wide above, the lower half tapering, narrow, terminating in a blunt apex, which is channeled and spout-like outside. Columellar margin thickened near and at the apex; palatal margin sinuous, bearing a sharp, high, keel-like thickening on the outside along its lower half; proximal end emarginate on the columellar side of the filament.

Length 32, diam. 7, longest axis of aperture 7.8 mm.

Length 30, diam. 7.3, longest axis of aperture 8.3 mm.

Length 26, diam. 6.3, longest axis of aperture 7 mm.

Kunchan, Okinawa (Mr. Y. Hirase, No. 632a).

" This species differs from *C. callistocheila* in the weak crenulation of the right lip, shorter principal plica, shorter and differently shaped lower palatal plica, the smaller upper palatal, which is united with the lunella, and especially in the different form of the clausilium.

Specimens No. 632b of Mr. Hirase's collection, also from Kunchan, the northern province of Okinawa, are green from adhering algæ, evidently having lived in a moist place. The crenulation of the lip is much less marked, there being but one or two interlamellar folds close to the superior lamella; the lower palatal fold and lunella are shortened, forming a sort of triangular buttressed pyramid; the lunella is very low above, and curves into a sub-

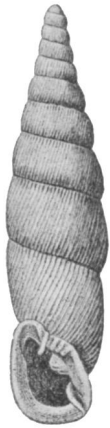
obsolete upper palatal fold. The clausilium is the same as in the typical form. The tip of the spire is sometimes lost.

Length 28, diam. 6.3, longest axis of aperture 7.2 mm.

Length 28.7, diam. 6, longest axis of aperture 7.2 mm.

*Clausilia excellens* Pfeiffer. Pl. XXIII, fig. 43.

This species was originally described by Gould as *C. præclara*, but this name being preoccupied it was changed by Pfeiffer to *C. excellens*. The species was known to Pfeiffer by Gould's description only.<sup>7</sup> Through the kindness of Prof. William H. Dall I am able to give a figure of the type specimen, from Loo Choo, in the National Museum.



It differs from *C. crenilabium* in the slightly stronger striation and the better development of the interlamellar crenulation; and from *C. crenilabium*, *ptychochila* and *Bernardii* in the grooving of the top of the inferior lamella, which is almost bifid. In *C. crenilabium* and *C. Bernardii* the inferior lamella is only bifid far within, in a dorsal position, as shown in Pl. XXIII, fig. 25. In *C. excellens* this bifid structure has apparently moved downward to the lower end of the lamella.

The clausilium of *C. excellens* is still unknown, as the type specimen has not been opened; and the subgeneric position of the species cannot, therefore, be considered certain. It may possibly be a *Luchuphædusa*.

#### Group of *C. minus*.

A group of uncertain systematic position, probably referable to *Tyrannophædusa* rather than to *Hemiphædusa*; but more material and further study is needed to determine to what extent *Hemiphædusa* is heterogeneous, and how it may best be subdivided. The heavy thickening of the distal end of the clausilium on the columellar side, and its short form, remove the species described below from *Hemiphædusa*, but it differs from the typical forms of *Tyrannophædusa* in the comparatively few-whorled shell and in details of the palatal armature.

<sup>7</sup>See p. 409, footnote No. 2. There is a very poor figure of *C. excellens* in the *Conchologia Iconica*, XX, Pl. X, fig. 89.

*Clausilia munus* n. sp. Pl. XXIII, figs. 34, 35, 36.

Shell rather small, fusiform, slender and much attenuated above, rather obese below; brown and glossy when unworn, but often lustreless and more or less eroded. Finely and closely striate, the later half of the last whorl much more coarsely so. Whorls 9 to  $9\frac{1}{2}$ , rather convex, the penultimate whorl widest, the last whorl contracted, tapering. Aperture rhombic-ovate, the peristome whitish, reflexed, moderately thick, slightly emarginate at the position of the superior lamella. Superior lamella vertical, reaching the margin, continuous with the spiral lamella. Inferior lamella immersed, receding, not visible in a front view, but seen by looking obliquely into the aperture; almost straightly ascending inside. Subcolumellar lamella emerging to the lip-edge, with a groove on each side. Principal plica nearly a half whorl long, its end visible within the throat from the aperture, extending inward slightly beyond the closing apparatus. Upper palatal plica short, converging a little inwardly toward the principal plica; not connected with the arcuate, oblique, rather strong lunella, the lower end of which curves inward somewhat.

Length 15, diam. 3.5 mm.

Length 13.5, diam. 3.6 mm.

Length 13, diam. 3 mm.

Clausilium rather broad and short, tapering to a mucronate apex, heavily thickened on the columellar side at and near the apex, nearly straight, curved only near the filament, where it is abruptly narrowed, and deeply excavated or emarginate on the columellar side.

Oshima (Mr. Y. Hirase, No 646).

In general form this species resembles *C. brevior* and *C. awajensis*. It differs from the latter in the wider peristome, in having the lunella free from the upper palatal plica, and in the shape of the clausilium, which in this species resembles that of *Tyrannophædusa*, it being shorter and broader than in *Hemiphædusa*, and strongly thickened toward the apex, along the columellar side.

#### Section ZAPTYX Pilsbry.

*Vide* these *Proceedings* for 1900, pp. 446, 672.

*Clausilia hyperoptyx* Pilsbry.

This species was sent by Mr. Hirase as from "Loo Choo"—that is, I suppose, Great Loo Choo (Luchu), Nawa, or Okinawa Island. A further lot, No. 457*b*, has been sent from Yayeyama.

## EXPLANATION OF PLATES XXII AND XXIII.

PLATE XXII, Figs. 1-3.—*Clausilia callistochila*.

Fig. 4.—*Clausilia callistochila*. Clausilium, showing form of the apex.

Figs. 5, 6.—*C. oshima*. *I*, inferior lamella; *P*, lower end of the lower palatal plica; *S*, subcolumellar lamella; *Sp.*, spiral lamella; *Sup.*, superior lamella.

Figs. 7-10.—*C. pseudoshima*.

Fig. 11.—*C. pseudoshima*. Clausilium, turned to show form of the apex.

Fig. 12.—*C. oshima*. Clausilium, interior face; 13, profile from columellar side; 14, inner face, turned to show form of the apex.

Fig. 15.—*C. nesiothauma*. Clausilium, interior face; 16, the same, turned to show form of the apex.

Fig. 17.—*C. mima*. Clausilium, turned to show form of the apex; 18, interior face of the same.

Figs. 19-21.—*C. nesiothauma*. Fig. 20 showing the spiral and inferior lamellæ, and on the left side part of the lunella and lower palatal plica, with the dilated portion of the subcolumellar lamella.

PLATE XXIII, Figs. 23-25.—*C. crenilabium*. *I*, inferior lamella, *L*, lunella; *P*, lower palatal plica; *S*, subcolumellar lamella.

Fig. 26.—*C. crenilabium*. Clausilium, seen in profile from the columellar side; 27, apical view; 28, interior face; 29, the same turned to show shape of the apex.

Figs. 30-32.—*C. Bernardii*.

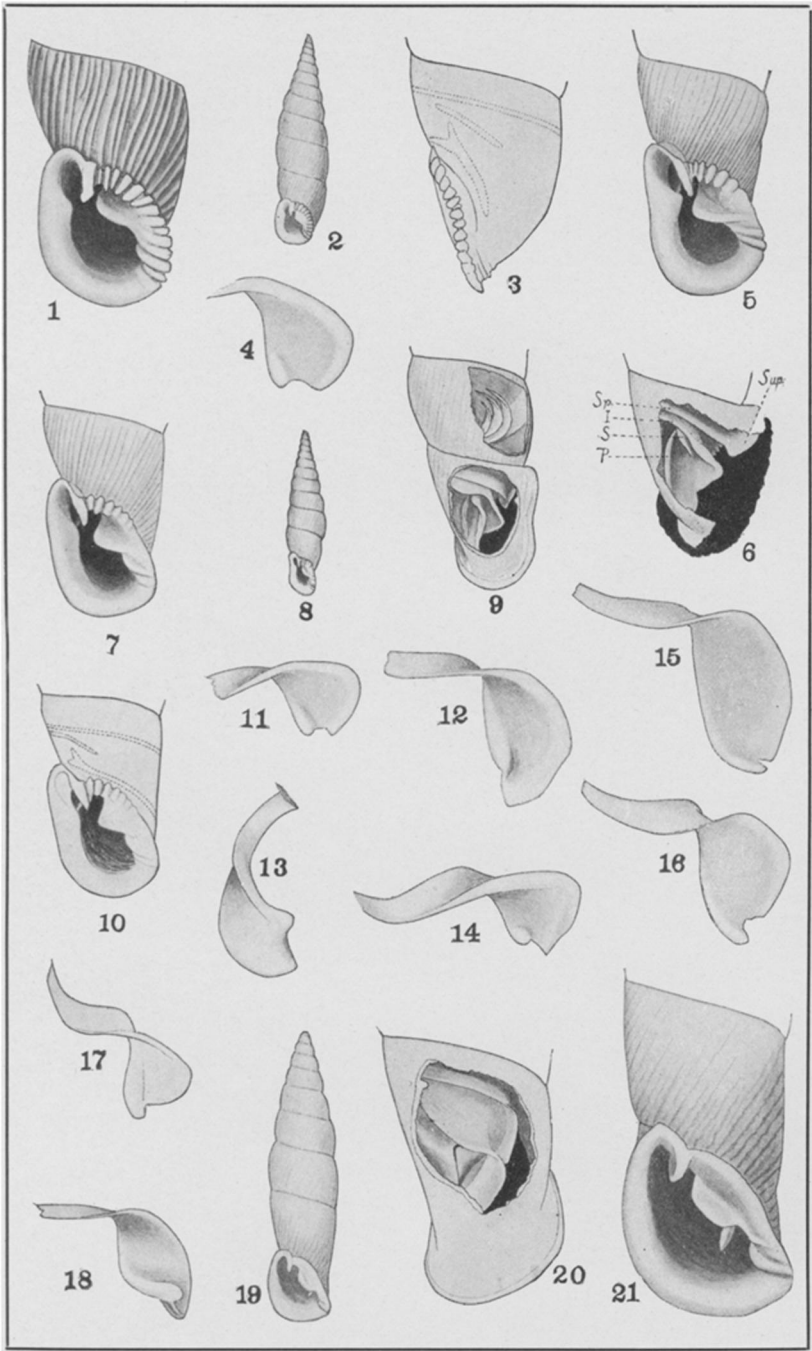
Fig. 33.—*C. crenilabium*.

Figs. 34-36.—*C. minus*.

Figs. 37-39.—*C. mima*.

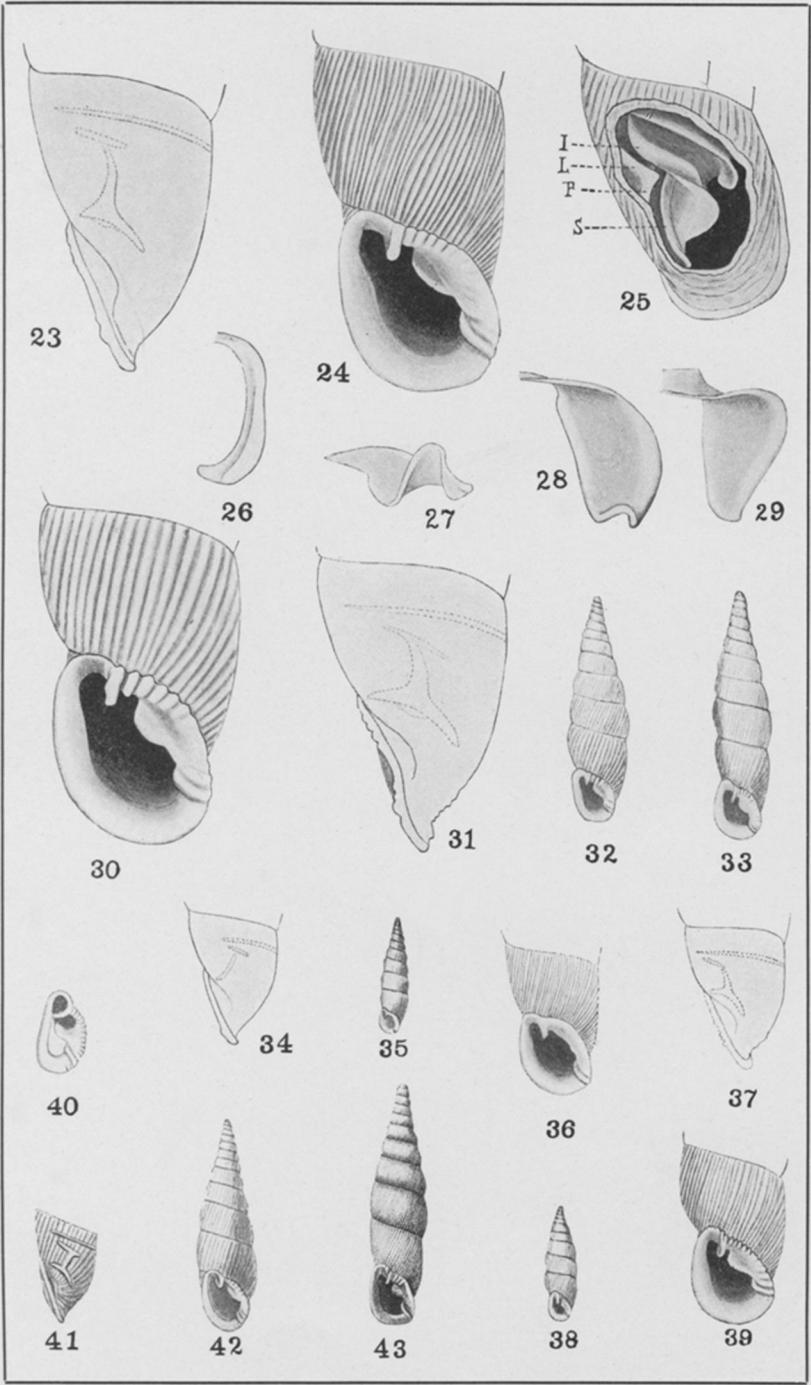
Figs. 40-42.—*C. pychochila* (copied from Boettger).

Fig. 43.—*C. excellens* (type specimen of *C. præclara* Gld., drawn by Dr. J. C. McConnell).



PILSBRY DEL.

PILSBRY. CLAUSILIIDÆ OF LOO CHOO ISLANDS.



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